Space Weather Technical Forecast

Issued on Friday, 01 July 2022 at 01:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active electron fluence continuing. Slight chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the last 24 hours, with one C1.4 flare. There are four sunspot regions on the visible disc. AR3040 is now a mature and somewhat decaying group, its trailing spot having recently lost its penumbra. AR3042 quickly declined to a unipolar group. AR3045, in the southeast quadrant, appears weak and inactive. There is also an unnumbered region emerging over the northeast limb which appears to a basic alpha region, but it is currently difficult to analyse it due to the narrow viewing angle. No Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed, as observed at L1, has followed a declining trend through the last 24 hours, from 430 to 340km/s. Density has been mainly below average. Total interplanetary magnetic field was weak, with only negligible variations of the north-south component, Bz. Phi angle has been largely negative (towards the Sun). Resultant geomagnetic activity was Quiet.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) as measured by GOES16 remained at background levels throughout the period. The high energy electron flux remained high throughout, with a peak of 4550 pfu at 30/1605UTC. Corresponding electron fluence was above the Active (1e8 integrated pfu) threshold with a slight rising trend. An observed fluence of 2.45e8 integrated pfu was recorded at 01/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low or Very Low, with a Very Slight chance of Moderate activity

Solar Wind / Geomagnetic Activity: A slow CME which left the Sun on 26 June may arrive at Earth on 02 July, but is most likely to be engulfed by the ambient solar wind. A further CME may arrive at Earth by the end of 04 July, but with low confidence. Solar winds are expected to remain at slow-ambient levels through the period. Geomagnetic activity is forecast to be mainly Quiet, with isolated Unsettled intervals.

Energetic Particles / Solar Radiation: In the absence of any significant sunspot development, the high energy proton flux (greater than 10 MeV) is expected to remain at background levels. The diurnal peaks of the high energy electron flux (greater than 2MeV) are expected to follow a slow declining trend through the next four days, but still reach high levels on the peak. Electron fluence is forecast to start to slowly decline, but is unlikely to fall below the Active threshold until day 3 (03rd July).

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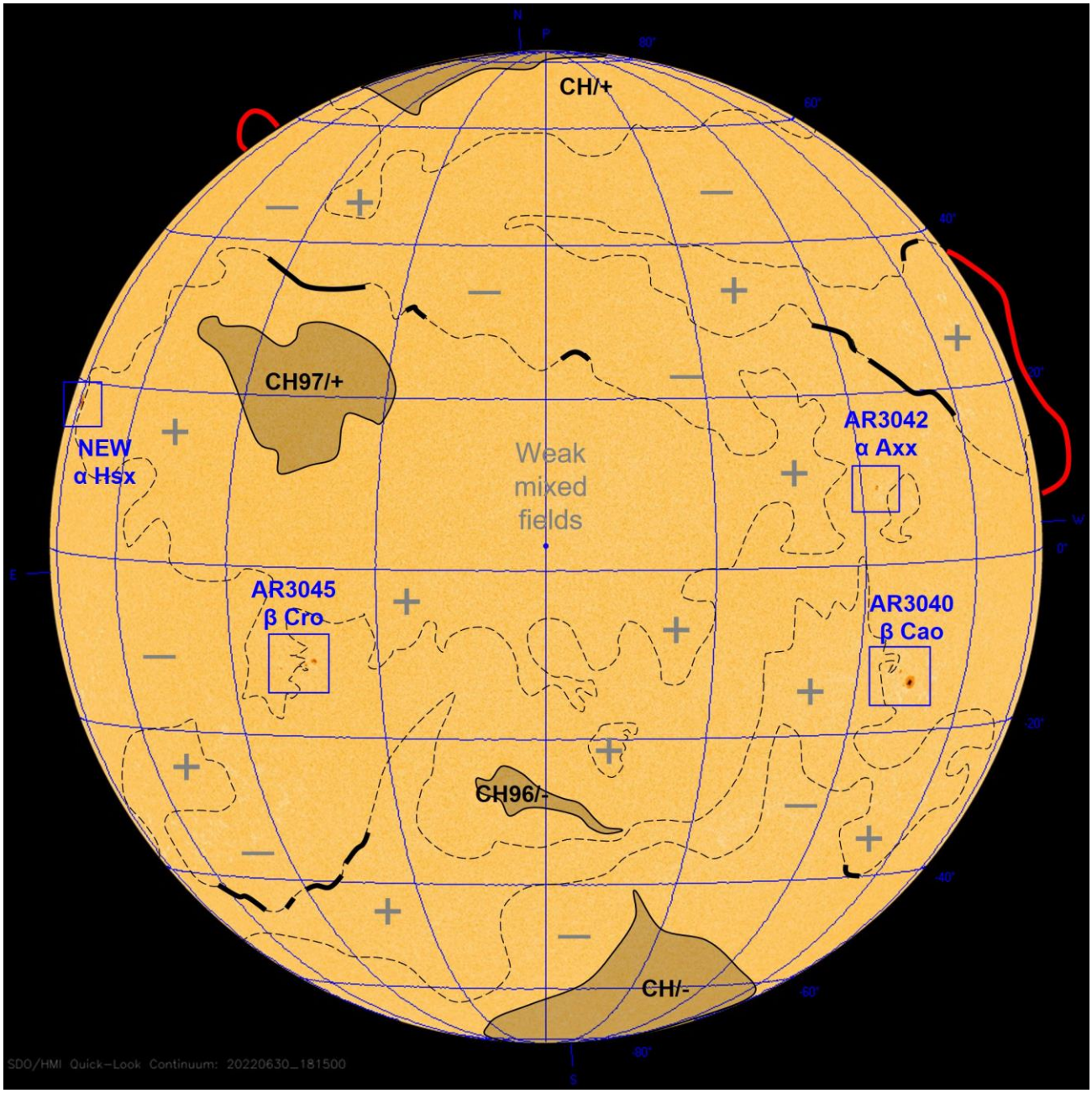
Figure 1. Solar Analysis Valid 30/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:
A CME which left the Sun on 26 June, may arrive at Earth on 02 July, however the speed is slow, so the feature may merge with the background solar wind. A further CME which left the Sun on 28 June is currently forecast to arrive at Earth either late on 04 July, or during 05 July. No other Earth-directed CMEs currently feature in this forecast.

Aside from the CMEs, solar winds are expected to persist at slow-ambient levels through the period. CH96/- may bring a slight enhancement on Day 4 (04th) however, this feature is small and most likely to have a minor influence. No significant enhancements expected during this forecast.

Geomagnetic activity is expected to be mainly Quiet with isolated Unsettled intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Enlil Ensembles, showing an expected CME arrival on the 02nd-03rd

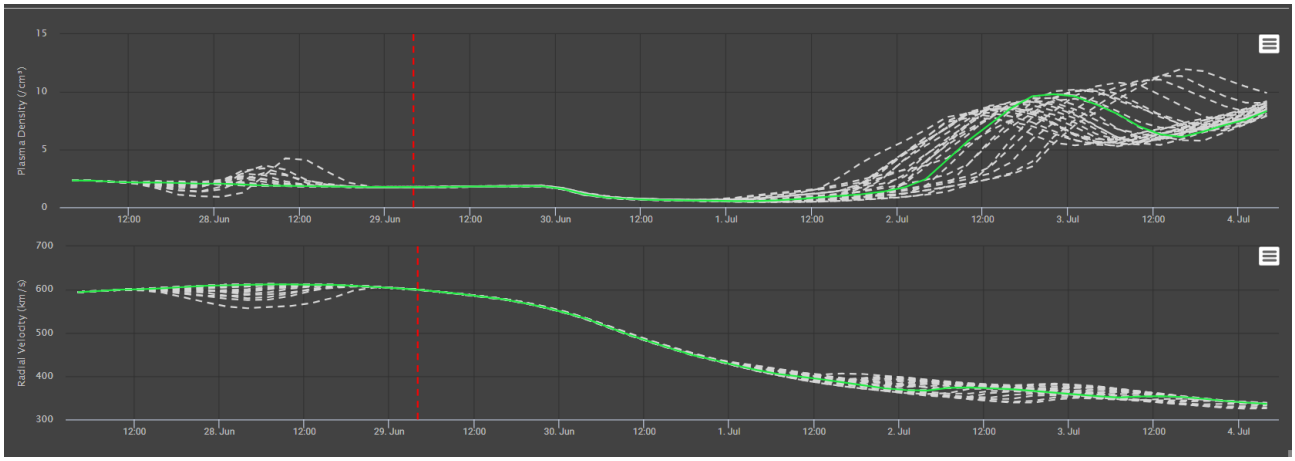

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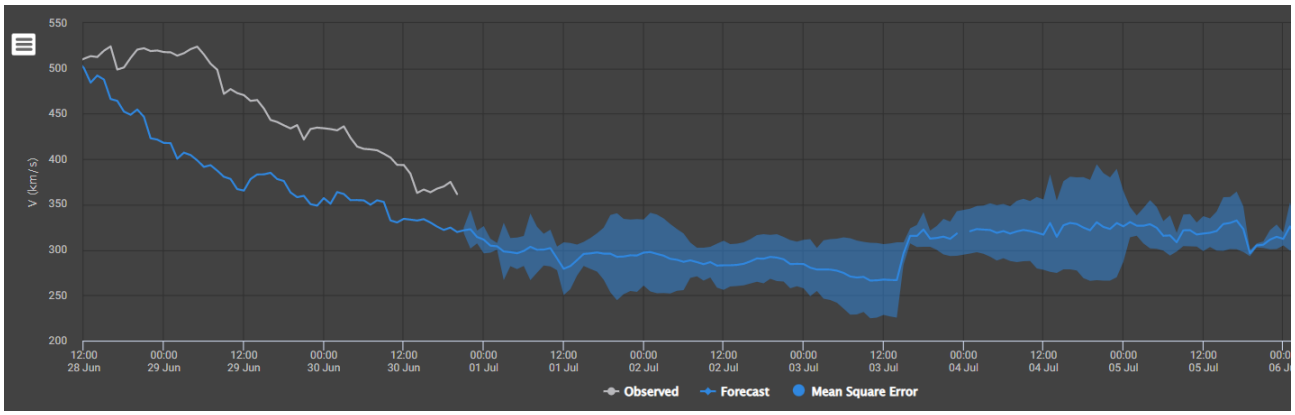
Figure 3: Solar Wind Persistence Model (SWPM), considered to provide good guidance.



Radio Blackouts - X-Ray Flares:

Solar activity has been Low through the last 24 hours, with one C-class flare observed from a plage region rotating onto the northeast limb. This unnumbered region is likely to reveal increasing complexity as it rotates further into view, perhaps leading to an increasing risk over the following days.

There are three other sunspot regions on the visible disc. AR3040 is now a mature and somewhat decaying group, its trailing spot having recently lost its penumbra. AR3042 quickly declined to a unipolar group. AR3045, in the southeast quadrant, appears weak and inactive.

Solar activity is likely to be Low or Very Low during this period, with a Very Slight chance of Moderate activity

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

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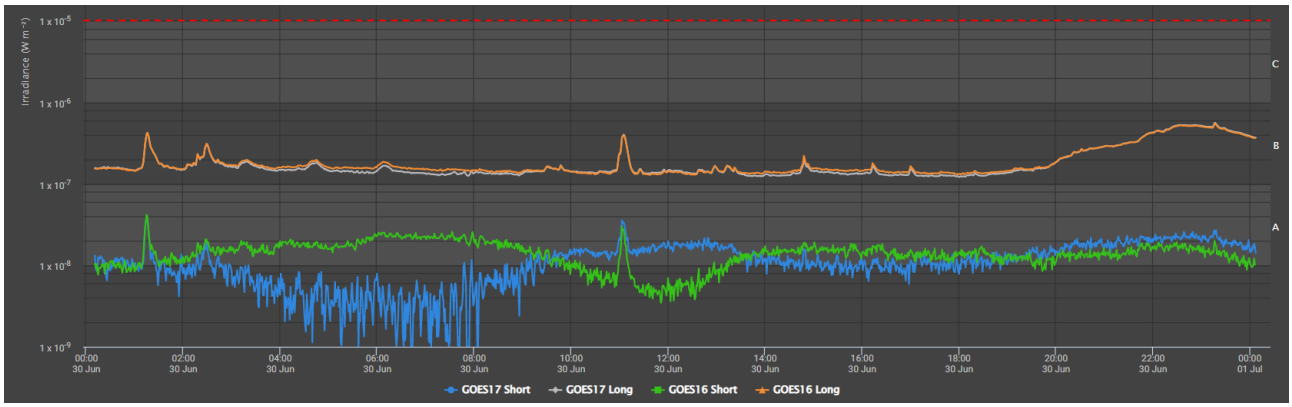
Figure 3: Latest GOES X-Ray flux showing very little activity



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at background levels, and will most likely remain at this level through the period, in the absence of any significant sunspot development.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) has been at high levels through the last 24 hours and is only expected to decline slowly through the next four days as the solar wind continues to ease. The arrival of the weak CME on Day 2 (02nd July) may cause levels to drop out but confidence is low as the associated velocity and density may not be strong enough to redistribute the electrons or distort the radiation belts. There should be a trend for the peak values to reduce through the next four days.

Electron fluence values are forecast to display a decreasing trend through the next four days and eventually fall below the Active threshold, perhaps on Day 3 (03rd) but more likely on Day 4 (04th). Again, confidence is low. The REFM is not considered to provide good guidance on this occasion, as the sharp decline displayed on Days 2 & 3 is associated to a glancing blow received from a CME on the last rotation. While a decline is expected, it should be much shallower.

GEO Electron Environment	Level (cm^{-2} sr^{-1}	Past 24 Hours	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)

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Probability (Exceedance)	day^{-1})	(Yes/No)	(%)	(%)	(%)	(%)
Active	**≥ 2 MeV ≥ 1x10^{8}**	Yes	100	70	50	30
Very Active	**≥ 2 MeV ≥ 1x10^{9}**	No	1	1	1	1

Figure 4: Latest REFM – not considered to give good guidance

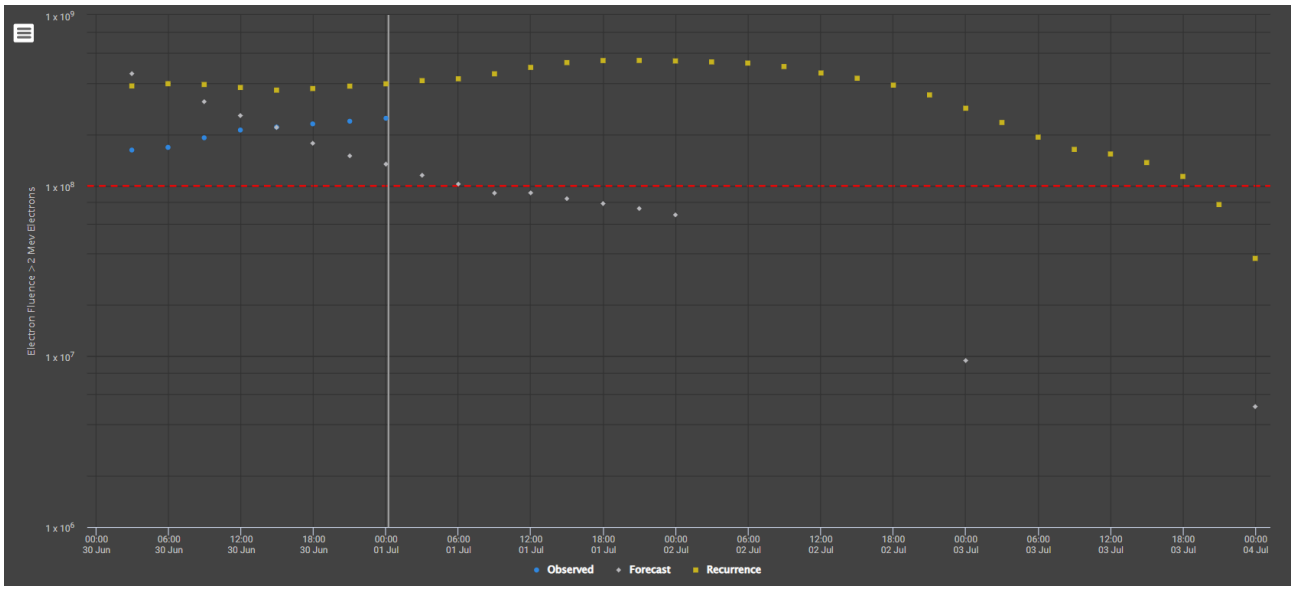
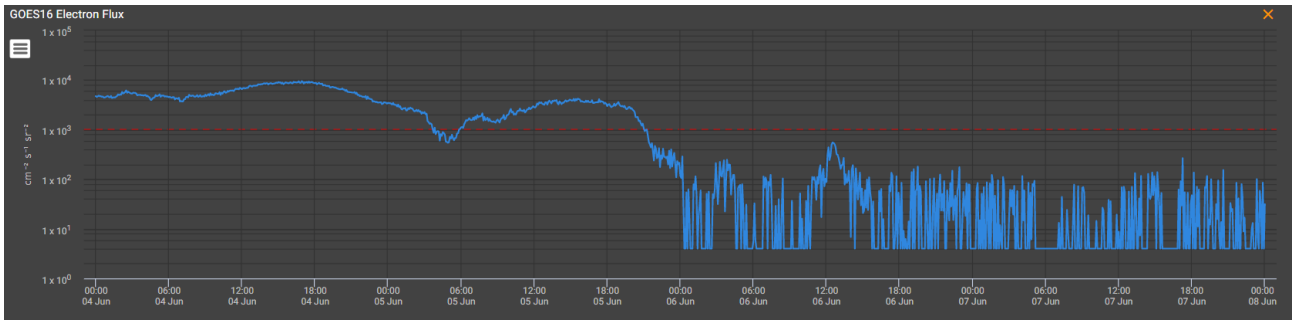


Figure 5: GOES16 Electron flux from the last rotation, showing a sharp drop at the end of the 05th June following a glancing blow from a CME.



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